

Building Modern Cometary Models Using Ancient Chinese Data

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- Over interval 1059
B.C. through A.D.
1500, Chinese records
are virtually the only
source for quantitative
observations of comets
 - 283 Asterisms
containing 1464 stars
 - 28 lunar mansions



**ANCIENT CHINESE DATA PROVIDE ONLY LONG-TERM SOURCE OF
INFORMATION ON:**

COMETARY OUTGASSING CHARACTERISTICS

FIRST AND LAST SIGHTINGS -> ABS. MAGNITUDE

ABS. MAGN. DIRECTLY RELATED TO OUTGASSING GAS & DUST

TIME VARIATION IN NONGRAV. ACCELERATIONS

YES - MAJOR SPIN AXIS MOTION WITH TIME

NO - SPIN AXIS ORIENTATION STABLE WITH TIME

RELATIVE MASSES OF COMETS

**ACTIVE COMET WITH NO NONGRAV. ACCEL. OVER LONG
PERIOD OF TIME => MASSIVE COMETARY NUCLEUS**

METEOR SHOWER CIRCUMSTANCES

MAPPING DUST DISTRIBUTIONS SURROUNDING COMET

COMET HALLEY

COMET'S OUTGASSING RATE AS FUNCTION OF HELIOCENTRIC DISTANCE DOES NOT VARY OVER LONG TIME INTERVALS.

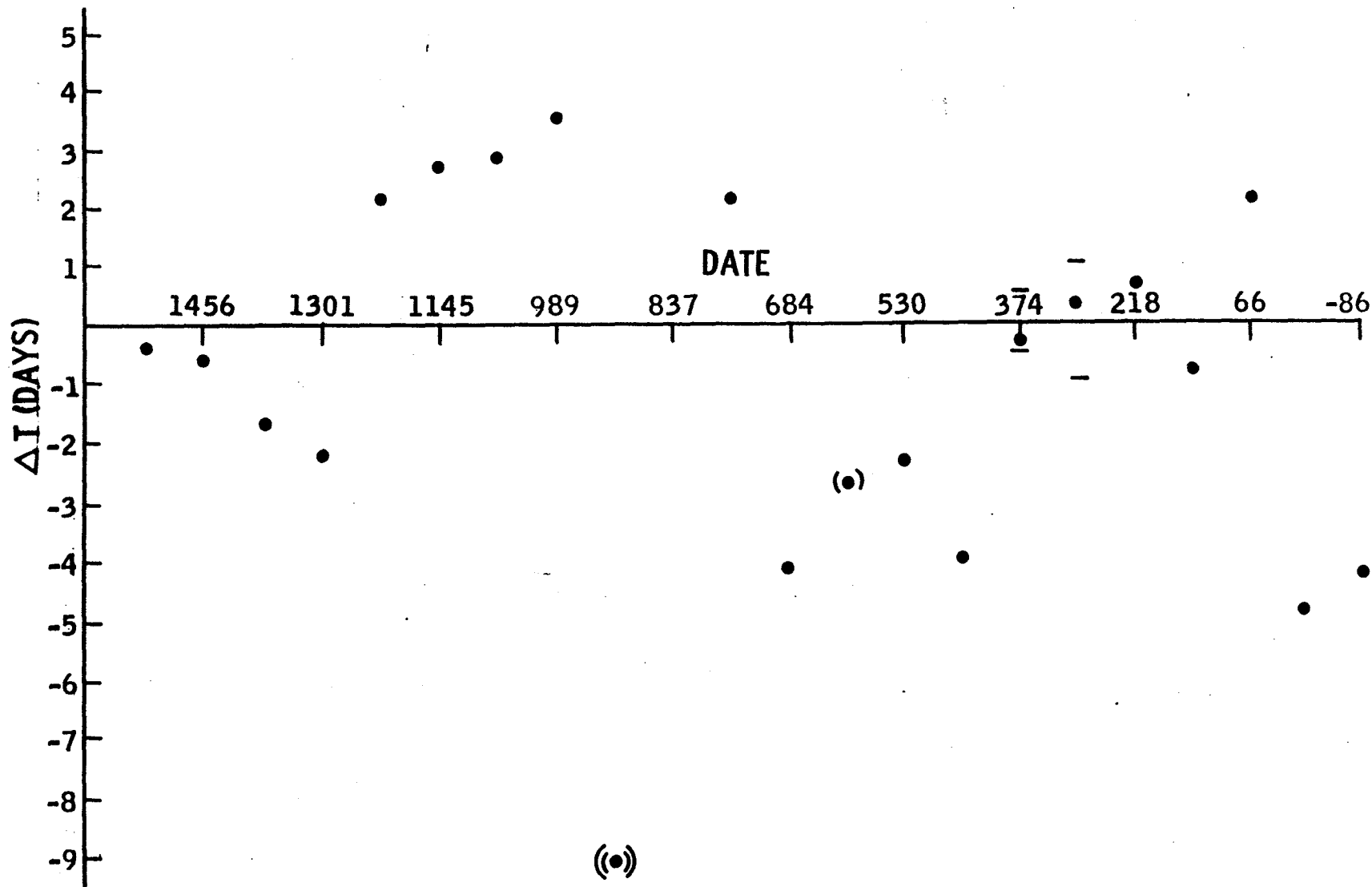
(OBSERVATIONS OF COMET FROM 164 B.C. TO A.D. 1991 CAN BE REPRESENTED WITH NO TIME DEPENDENCE IN ITS MODELLED NONGRAVITATIONAL EFFECTS)

NO OBVIOUS DECREASE IN COMET'S ABS. MAGNITUDE WITH TIME

(FOR EACH FIRST AND LAST SIGHTING BY CHINESE, AN ESTIMATE OF COMET'S ABS. MAGN. CAN BE MADE BECAUSE ITS COMPUTED DISTANCES FROM EARTH AND SUN ARE WELL KNOWN)

**HENCE, THE FOLLOWING CAN BE SAID ABOUT HALLEY'S NUCLEUS:
ACTIVE VENTS ARE STABLE OVER ~ 2000 YEARS
SPIN AXES ORIENTATION STABLE OVER SAME INTERVAL**

COMET HALLEY
OBSERVED - COMPUTED TIMES OF
PERIHELION PASSAGE (ΔT)
 1531 AD to 87 B.C.



COMET SWIFT-TUTTLE

ENTIRE OBSERVATIONAL INTERVAL FROM 69 B.C. TO 1993
CONSISTENT WITH NO NONGRAVITATIONAL EFFECTS.

NONGRAVITATIONAL CORRECTION TO PERIHELION TIME =

+ 4 DAYS/PERIOD	HALLEY
0	SWIFT-TUTTLE

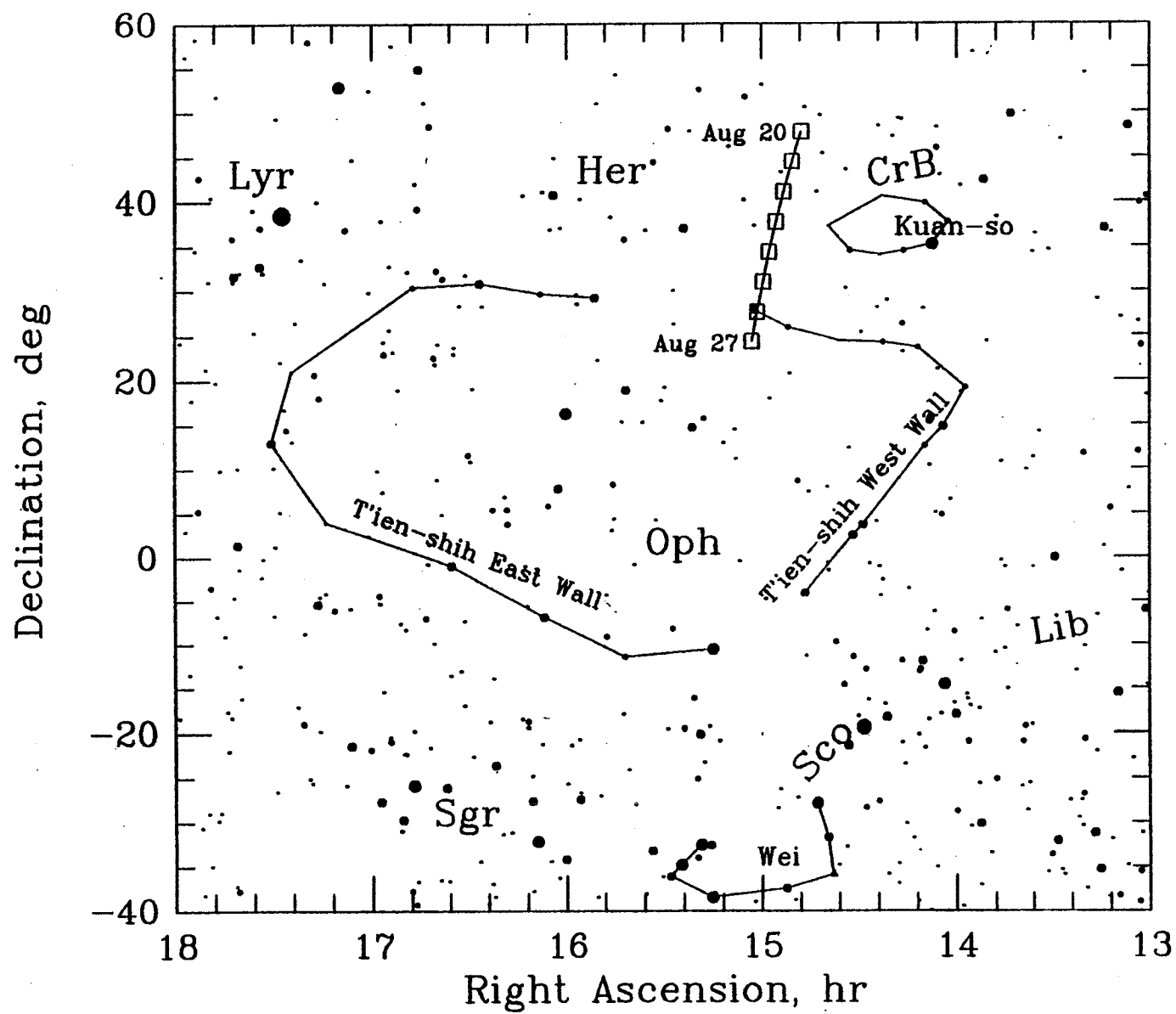
GAS PRODUCTION RATES OF SWIFT-TUTTLE AND HALLEY COMPARABLE

SWIFT-TUTTLE	$Q \sim 1 - 3 \times 10^{29}$	FOR $R = 1.0 - 1.1$
HALLEY	$Q \sim 3 - 6 \times 10^{29}$	FOR $R = 1.0 - 1.1$

ABS. MAG. OF SWIFT-TUTTLE & HALLEY CONSTANT WITH TIME

OUTGASSING IS PROBABLY RELATIVELY CONSTANT AND THE
COMETARY MASS IS LARGE ENOUGH THAT OUTGASSING DOES NOT
INTRODUCE A NONGRAVITATIONAL ACCELERATION

P/SWIFT-TUTTLE 69 BC RETURN



COMET TEMPEL-TUTTLE

COMET HAS BEEN SPARSELY OBSERVED AT ONLY 4 APPARITIONS

1965	JUNE - JULY	(ONLY 4 OBSERVATIONS)
1865	DEC. - 1866	FEB.
1699	OCT.	(SINGLE OBS. BY G. KIRCH)
1366	OCT. 25-29	(PO COMET OBSERVED BY CHINESE)

NONGRAV. EFFECTS ARE REQUIRED TO FIT LAST 3 APPARITIONS

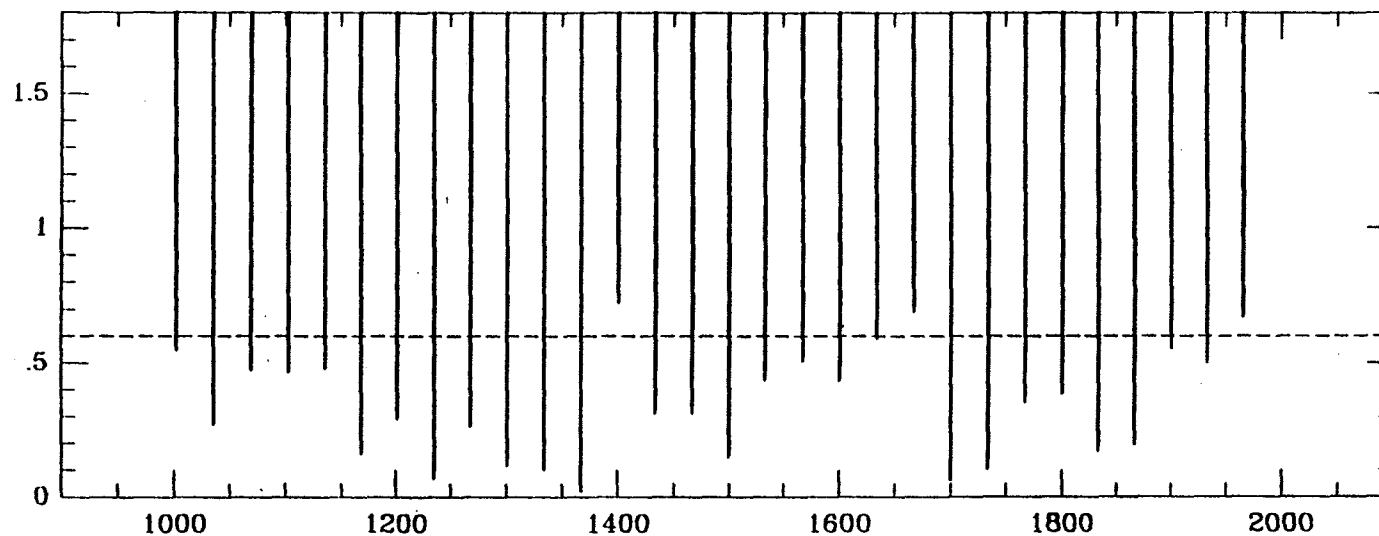
COMET IS INTRINSICALLY FAINT YET ACTIVE - PROBABLY SMALL

SHOULD EXPECT SUBSTANTIAL NONGRAVITATIONAL EFFECTS

LEONID METEORS DOCUMENTED BACK TO AT LEAST A.D. 902

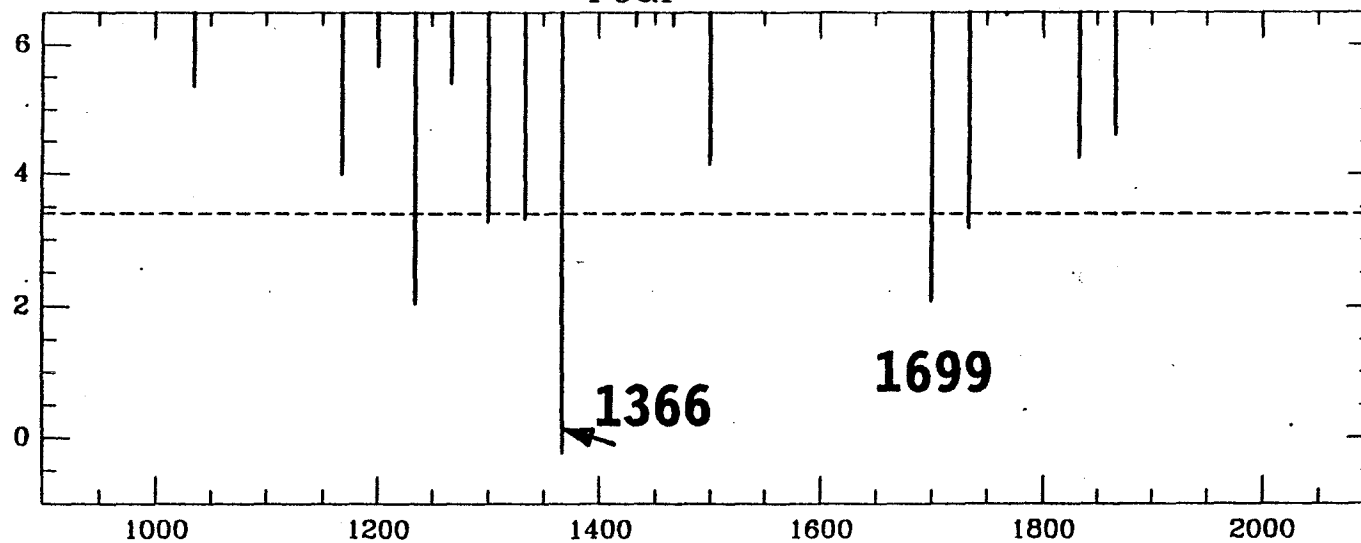
COMET TEMPEL-TUTTLE

Geocentric Distance, AU



Year

Magnitude



Year

BUILDING MODERN COMETARY MODELS USING ANCIENT CHINESE DATA

SUMMARY

ANCIENT CHINESE DATA HAVE BEEN USED TO MAKE THE FOLLOWING CONCLUSIONS CONCERNING COMETARY NUCLEI:

COMET HALLEY

SPIN AXIS STABLE OVER 2 MILLENNIA

ACTIVITY OF VENTS NEARLY CONSTANT FOR SAME INTERVAL

COMET SWIFT-TUTTLE

NUCLEUS PERHAPS 10 TIMES MORE MASSIVE THAN COMET HALLEY

ACTIVITY NEARLY CONSTANT OVER 2 MILLENNIA

COMET TEMPEL-TUTTLE

PROBABLY SMALLER THAN EITHER HALLEY OR SWIFT-TUTTLE

STRONG METEOR SHOWERS (STORMS?) LIKELY ON:

1998 NOV. 17.82

1999 NOV. 18.08